(19) Japan Patent and Trademark Office (JP)

(12) LAID OPEN [*KÔKAI*] PATENT GAZETTE (A)

(11) Patent Laid Open Application Publication No.: 2000-178096 (P2000-178096A)

(43) Date Laid Open: June 27, 2000

(51) Int. Cl.[7]	ID Symbol	F I	Subject Code (Ref.)
C30B 15/02		C30B 15/02	4G077

Inspection Request: Not filed Number of Claims: 6 OL (Total 5 pages in original)

(21) Application No.: H10-360775

(22) Date Submitted: December 18, 1998

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F Subjects (Ref.) 4G077 AA02 BA04 CF00 CF08 HA12 PB02 PB09 PB11

(54) Patent Title: Polycrystal raw material and polycrystal raw material support jig

(57) [Abstract]

[Purpose] To a polycrystal raw material support jig that is able to securely support polycrystal raw material and can safely be melted all the way to the end.

[Means of Solution] A polycrystal raw material support jig for supporting polycrystal raw material 1 and supplying it to a crucible so that it can be melted, wherein which polycrystal raw material support jig is characterized by having a constitution such that the polycrystal raw material 1 is supported so that it is pinched by a support means 14 and the polycrystal raw material 1 is dropped into the crucible while the polycrystal raw material 1 is being melted by employing the opening and closing operation of the support means 14.

[FIGURES]

[Scope of the Patent Claim]

[Claim 1] A polycrystal raw material support jig for supporting polycrystal raw material (1) and supplying it to a crucible so that it can be melted, wherein which polycrystal raw material support jig is characterized by having a constitution in which a support means (14) with opening and closing operation is provided, the polycrystal raw material (1) is supported by pinching it by means of the closing operation of the support means (14), and the polycrystal raw material (1) is dropped into the crucible while the polycrystal raw material (1) is being melted by opening operation of the support means (14).

[Claim 2] The polycrystal raw material support jig described in Claim 1, which is characterized by the support means (14) being equipped with linking members (12) that can be rotated around pivots (13), with a pivot (13) in the middle of each linking member (12) and a pawl member (15) and a weight member (16) at one end and the other of each linking member (12), and by being constituted so that the pawl members (15) are closed by gravity acting on the weight members (16).

[Claim 3] The polycrystal raw material support jig described in Claim 2, which is characterized by the polycrystal raw material (1) being a rod, with a support groove (17) formed in its side, and by the polycrystal raw material (1) being supported by the pawl members (15) hooking into said groove (17).

[Claim 4] The polycrystal raw material support jig described in Claim 2, which is characterized by having a constitution wherein limiting members (19, 20) are provided to restrict the closed condition of the pawl members (15) and a drop notch (18) is formed in the top of the polycrystal raw material (1) so that the pawl members (15) will attempt to close toward the limit position as melting proceeds to, or nearly to, the bottom of the drop notch, whereupon receiving this force, the polycrystal raw material will cleave at the drop notch (18) and drop off of the pawl members (15).

[Claim 5] A polycrystal raw material (1) that is supplied to a crucible and melted, wherein which polycrystal raw material is characterized by being comprised with a groove (17) formed at its upper circumferal surface for supporting said polycrystal raw material (1) and with a drop notch (18), which

is deeper than the position of the aforementioned groove (17), formed in its upper surface.

[Claim 6] The polycrystal raw material described in Claim 5, which is characterized by the drop notch (18) in the polycrystal raw material (1) being formed with a cross-sectional V-shape or cross-sectional square shape.

[Detailed Description of the Invention]

[0001]

[Field of Industrial Application] This invention pertains to a polycrystal raw material and to a polycrystal raw material support jig for the purpose of supporting said polycrystal raw material and supplying it to a crucible so that it can be melted.

[0002]

[Prior Art] The CZ (Czochralski) method is a method in which a polycrystal raw material, e.g., silicon, is melted in a crucible, and then a single crystal is grown and drawn from said melt. A polycrystal raw material support jig is used when charging the crucible with the polycrystal raw material.

[0003] A past polycrystal raw material support jig will be explained referring to Figure 5.

[0004] The support jig in Figure 5 is one in which a rod-shaped polycrystal raw material 1 is supported by wrapping and tying a tungsten or molybdenum wire 2 around the polycrystal raw material rod.

[0005]

[Problems to be Solved by the Invention] However, the following kinds of problems were encountered with the past support jig, described above.

[0006] With the foregoing support jig, the top of the polycrystal raw material rod could not be melted, as shown in Figure 5(c). In addition, if the wire 2 were improperly wrapped or tied, there was a danger that the wire 2 would come loose and the polycrystal raw material would drop.

[0007] Addressing these kinds of problems in the prior art, the purpose of this invention is to provide a polycrystal raw material and polycrystal raw material support jig that make it possible to securely support the polycrystal raw material and allow it to safely be melted all the way to the end.

[0008]

[Means of Solving Problems] As means of solving these problems, this invention comprises a polycrystal raw material support jig for supporting polycrystal raw material and supplying it to a crucible so that it can be melted, wherein which polycrystal raw material support jig is characterized by having a constitution in which two or more support means with opening and closing operation are provided, the polycrystal raw material is supported by pinching it with the support means, and the polycrystal raw material is dropped into the crucible while the polycrystal raw material is being melted by employing the opening and closing operation of the support means, and a polycrystal raw material (1) that is supplied to a crucible and melted, wherein which polycrystal raw material is characterized by being comprised with a groove (17) formed at its upper circumferal surface for supporting said polycrystal raw material (1) and with a drop notch (18), which is deeper than the position of the aforementioned groove (17), formed in its upper surface.

[0009]

[Condition of Embodiment of the Invention] The polycrystal raw material support jig of this invention provides a support means with opening and closing operation, whereby the polycrystal raw material is supported by pinching it by closing the support means and the polycrystal raw material is dropped into the crucible while the polycrystal raw material is being melted by opening the support means.

[0010] It is preferable if the support means is equipped with linking members that can be rotated around pivots, with a pivot in the middle of each linking member and a pawl member and a weight member at one end and the other of each linking member, and by being constituted so that the pawl members are closed by gravity acting on the weight members.

[0011] A support groove can be formed in the side of the rod-shaped polycrystal raw material and the polycrystal raw material can be supported by the pawl members hooking into said groove.

[0012] It is preferable for polycrystal raw material support jig to have a constitution wherein limiting members are provided to restrict the closed

condition of the pawl members and a drop notch is formed in the top of the polycrystal raw material so that the pawl members will attempt to close toward the limit position as melting proceeds to, or nearly to, the bottom of the drop notch, whereupon receiving this force, the polycrystal raw material will cleave at the drop notch and drop off of the pawl members.

[0013] The drop notch in the polycrystal raw material can be formed with a cross-sectional V-shape or cross-sectional square shape.

[0014] Example embodiments of this invention will be described below, referring to the attached drawings.

[0015] Figure 1 shows an example application of the polycrystal raw material and polycrystal raw material support jig of this invention, wherein (a) is a side-view drawing showing the state in which the polycrystal raw material is supported, illustrated with the support means brought to the left and right positions and with the polycrystal raw material shown in cross section. (b) in this figure shows a stage during the melting of the polycrystal raw material, and (c) shows the remnants of the polycrystal raw material being dropped. Figures 2(a) and (b) are top-view drawings showing the frames and environs of the support jig in Figure 1.

[0016] The polycrystal raw material support jig 10 is an appliance for supporting the polycrystal raw material 1 and supplying it to the crucible of a single crystal production device so that it can be melted.

[0017] The polycrystal raw material 1 is a cylindrical rod with a groove 17 for engaging the pawl members formed in its upper circumferal surface. This support groove 17 passes once around the polycrystal raw material 1, but it could also be formed in only part of the surface.

[0018] A drop notch 18 with a square or V-shaped sectional profile is also formed in the top surface of the polycrystal raw material 1. The depth of the drop notch 18 extends deeper than the bottom of the support groove 17. Figures 2(c) and (d) show examples of different configurations of the drop notch in the top surface.

[0019] The polycrystal raw material support jig 10 possesses a frame 11. The frame 11 has a format in which a circular part and axial parts are linked together.

[0020] A single or multiple support means 14 are mounted to the circular part of the frame 11 to support the polycrystal raw material 1. Each support means 14 is constituted to perform opening and closing operations. In Figure 2, (a) shows an arrangement in which three support members 14 are provided, and (b) shows an arrangement in which four are provided. The support positions on the polycrystal raw material 1 in these cases are the positions shown by the triangular arrows 15a in Figures 2(c) and (d).

[0021] Each support means 14 comprises a linking member 12, a pawl member 15, and a weight member 16. The linking member 12 is set onto the frame 11 so that it can rotate around a pivot 13. The linking member 12 is a "<"-shaped rod, with its bend forming the pivot point 13. A pawl member 15 and a weight member 16 are disposed at one end and the other, respectively, of the linking member 12. The pawl member 15 can be formed by bending one end of the linking member 12 into a hook shape.

[0022] Since the pawl members close toward the inside by the force of gravity acting on the weight members 16 (see arrows B in Figure 1(a)), the polycrystal raw material 1 can be securely supported. In addition, since the polycrystal raw material 1 is supported by opening the pawl members 15 by lifting the weight members 16 upward during the polycrystal raw material 1 loading operation, the operation can be performed without the operator touching the polycrystal raw material, making it possible to avoid contamination by the operator.

[0023] Protrusions 19 and 20 are situated respectively at a location slightly toward the pawl member 15 from the pivot 13 of each linking member 12 and at a corresponding location on the bottom of the frame 11. These protrusions 19, 20 are limiting members that restrict rotation of the linking members, i.e., the closed condition of the pawl members 15. When the two protrusions 19, 20 are engaged, as shown in Figure 1(b), the rotation of the

linking members 12 is restricted, preventing the pawl members 15 from closing any further.

[0024] As melting of the polycrystal raw material progresses to the point that it is melted up to line A-A in Figure 1(a), the linking members 12 are caused to rotate to the limiting position described above by the gravity acting on the weight members 16, bringing the pawl members 15 to their most closed condition. With this, the remnants 1a, 1b of the polycrystal raw material 1 are split so that they rotate inward, as shown in Figure 1(b), releasing them from being supported by the pawl members 15. The remnants 1a, 1b of the polycrystal raw material 1 then drop nestled together, as shown in Figure 1(c).

[0025] Thus, due to the closing action of the pawl members 15, the remnants 1a, 1b of the polycrystal raw material 1 drop accurately into the crucible as a single clump, without being flung outward. This is the same regardless of the number of support points 15a.

[0026] In another example embodiment shown in Figures 3 and 4, the drop notch 18 formed in the top of the polycrystal raw material 1 is formed with a square sectional profile. All other structures are the same as in the example embodiment shown in Figures 1 and 2.

[0027] In this example embodiment as well, the same effect can be achieved by the closing action of the pawl members 15, as shown in Figures 3(b) and (c).

[0028] Of course, the shape of the drop notch could as well have a semicircular or U-shaped sectional profile. However, these drop notches would be formed so that the multiple support points were divided into at least multiple sets.

[0029] Example Embodiment 1 and Comparison Example 1

A charging tests were performed with a 5″-diameter, approximately 600mm-long, 18kg polycrystal raw material rod, using the support jig of this invention shown in Figures 1 and 2(a) (Example Embodiment 1) and the past support jig shown in Figure 5 (Comparison Example 1).

[0030] As a result, the entire polycrystal raw material rod in Example Embodiment 1 was able to be melted, without the dropping polycrystal raw material striking the crucible or the surrounding parts. In addition, since the polycrystal raw material rod was supported by being pinched by three pawl members, it was able to be supported in a stable condition without tilting.

[0031] In contrast, up to approximately 15kg of the polycrystal raw material in Comparison Example 1 was able to be melted, while the remaining approximately 3kg were unable to be melted.

[0032] Now, this invention is not limited to the example embodiment described above. For example, if four pawl members were provided, the drop notches disposed in the top of the polycrystal raw material could be formed in a cross ("+") pattern. In addition, the linking members could be branched midway, with two or more pawl members disposed on one linking member.

[0033]

[Effect] With the polycrystal raw material and polycrystal raw material support jig of this invention, the polycrystal raw material can be securely supported and safely melted all the way to the end.

[Brief Explanation of the Figures]

[Figure 1] This is shows an example embodiment of the polycrystal raw material and polycrystal raw material support jig of this invention, wherein (a) is a side-view drawing showing the state in which the polycrystal raw material is supported, illustrated with the support means brought to the left and right positions and with the polycrystal raw material shown in cross section.

(b) in this figure shows a stage during the melting of the polycrystal raw material, and (c) shows the remnants of the polycrystal raw material being dropped.

[Figure 2] Figures (a) and (b) are top-view drawings showing the frames and environs of the support jig in Figure 1, and (c) and (d) are drawings showing the support points on the polycrystal raw material.

[Figure 3] This is a figure that corresponds with Figure 1 in a case in which the drop notches provided in the polycrystal raw material have a square sectional profile.

[Figure 4] This is a drawing showing the support points on the polycrystal raw material in the case in Figure 3.

[Figure 5] This is a drawing showing a comparison example of a polycrystal raw material support jig.

[Legend]

1 polycrystal raw material

12 linking member

13 pivot

14 support means

15 pawl member

16 weight member

17 support groove

18 drop notch

[Fig. 1] [Fig. 2]

[FIGURES]

[Fig. 3]

[Fig. 4]

[FIGURES]

[Fig. 5]

[FIGURES]

(19)日本国特許庁（ＪＰ）　(12)公開特許公報（A）　(11)特許出願公開番号
特開2000－178096
（P2000－178096A）
(43)公開日　平成12年６月27日(2000.6.27)

(51)Int.Cl.'	識別記号	ＦＩ	ﾃｰﾏｺｰﾄﾞ(参考)
Ｃ３０Ｂ　15/02		Ｃ３０Ｂ　15/02	４Ｇ０７７

審査請求　未請求　請求項の数６　ＯＬ　（全５頁）

(21)出願番号　特願平10－360775

(22)出願日　平成10年12月18日(1998.12.18)

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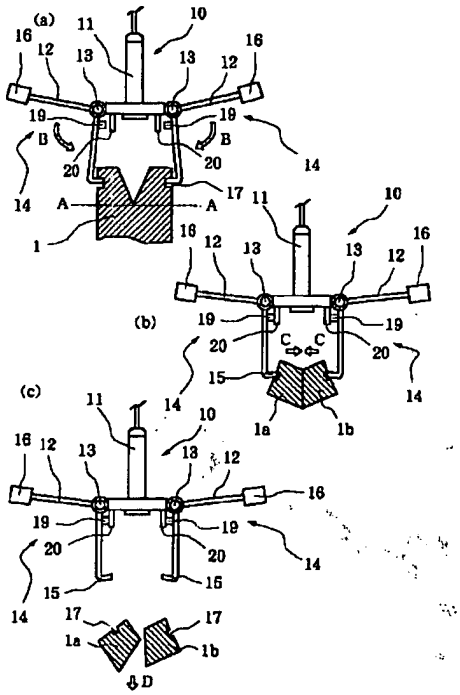
Ｆターム(参考)　4G077 AA02 BA04 CF00 CF08 HA12 PB02 PB09 PB11

(54)【発明の名称】　多結晶原料および多結晶原料支持治具

(57)【要約】
【課題】　多結晶原料を確実に支持することができ、これを最後まで安全に溶融させることができる多結晶原料支持治具を提供する。
【解決手段】　多結晶原料１を支持してルツボに供給し、これを溶融させるための多結晶原料支持治具において、支持手段１４で多結晶原料１を挟むように支持し、多結晶原料１を溶融する途中で、支持手段１４の開閉動作を利用して多結晶原料１をルツボ内に落下させる構成にしたことを特徴とする多結晶原料支持治具。



【特許請求の範囲】

【請求項１】　多結晶原料（１）を支持してルツボに供給し、これを溶融させるための多結晶原料支持治具において、開閉動作をする支持手段（１４）を設け、支持手段（１４）の閉動作で多結晶原料（１）を挟むように支持し、多結晶原料（１）を溶融する途中で、支持手段（１４）の閉動作で多結晶原料（１）をルツボ内に落下させる構成にしたことを特徴とする多結晶原料支持治具。

【請求項２】　支持手段（１４）が、支点（１３）を中心として回転可能な連結部材（１２）と、連結部材（１２）の支点（１３）の一方側と他方側に設けた爪部材（１５）と重り部材（１６）とを備え、重り部材（１６）に作用する重力によって爪部材（１５）を閉じる構成になっていることを特徴とする請求項１に記載の多結晶原料支持治具。

【請求項３】　多結晶原料（１）が棒状であり、その側部に支持用の溝（１７）を形成し、その溝（１７）に爪部材（１５）を引っ掛けて多結晶原料（１）を支持することを特徴とする請求項２に記載の多結晶原料支持治具。

【請求項４】　爪部材（１５）の閉じ具合を制限するための制限部材（１９、２０）を設け、多結晶原料（１）の上部に落下用切り込み（１８）を形成し、落下用切り込み（１８）の底部又はその近くまで溶融が進むと、爪部材（１５）が制限位置まで閉じようとし、その力を受けつつ多結晶原料が落下用切り込み（１８）で分割され、爪部材（１５）から外れて落下する構成になっていることを特徴とする請求項２に記載の多結晶原料支持治具。

【請求項５】　ルツボに供給されて溶融される多結晶原料（１）において、その上部周面には当該多結晶原料（１）を支持するための溝（１７）が形成され、かつ上面には前記溝（１７）の位置よりも深く落下用切り込み（１８）が形成されて成ることを特徴とする多結晶原料。

【請求項６】　多結晶原料（１）の落下用切り込み（１８）が、断面楔形または断面矩形状に形成されることを特徴とする請求項５に記載の多結晶原料。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】この発明は、多結晶原料およびこの多結晶原料を支持してルツボに供給し、これを溶融させるための多結晶原料支持治具に関するものである。

【０００２】

【従来の技術】ＣＺ(Chochlarski）法は、ルツボ内でシリコン等の多結晶原料を溶融し、その融液から単結晶を成長させつつ引き上げる方法である。ルツボ内に多結晶原料をチャージする際に、多結晶原料支持治具が用いられる。

【０００３】図５を参照して、従来の多結晶原料支持治具を説明する。

【０００４】図５の支持治具は、棒状多結晶原料１にＷ製やＭｏ製のワイヤ２を巻き付け結ぶことによって、これを支持するものである。

【０００５】

【発明が解決しようとする課題】しかし、前述した従来の支持治具には、次のような不具合があった。

【０００６】前者の支持治具では、図５（ｃ）のように棒状多結晶原料の上部を溶融することが出来なかった。また、ワイヤ２の巻き付け方や結び方が不適切な場合には、ワイヤ２が緩んで多結晶原料が落下してしまう恐れもあった。

【０００７】このような従来技術の問題点に鑑み、本発明は、多結晶原料を確実に支持することができ、これを最後まで安全に溶融させることができる多結晶原料および多結晶原料支持治具を提供することを目的としている。

【０００８】

【課題を解決するための手段】本発明は、多結晶原料を支持してルツボに供給し、これを溶融させるための多結晶原料支持治具において、開閉可能な２つ以上の支持手段を設け、この支持手段で多結晶原料を挟むように支持し、多結晶原料を溶融する途中で、支持手段の開閉動作を利用して多結晶原料をルツボ内に落下させる構成にしたことを特徴とする多結晶原料支持治具およびルツボに供給されて溶融される多結晶原料（１）において、その上部周面には当該多結晶原料（１）を支持するための溝（１７）が形成され、かつ上面には前記溝（１７）の位置よりも深く落下用切り込み（１８）が形成されて成ることを特徴とする多結晶原料を解決手段としている。

【０００９】

【発明の実施の形態】本発明の多結晶原料支持治具は、開閉動作をする支持手段を設け、支持手段の閉動作で多結晶原料を挟むように支持し、多結晶原料を溶融する途中で、支持手段の閉動作で多結晶原料をルツボ内に落下させるものである。

【００１０】支持手段が、支点を中心として回転可能な連結部材と、連結部材の支点の一方側と他方側に設けた爪部材と重り部材とを備え、重り部材に作用する重力によって爪部材を閉じる構成にすることが好ましい。

【００１１】棒状の多結晶原料の側部に支持用の溝を形成し、その溝に爪部材を引っ掛けて多結晶原料を支持することができる。

【００１２】爪部材の閉じ具合を制限するための制限部材を設け、多結晶原料の上部に落下用切り込みを形成し、落下用切り込みの底部又はその近くまで溶融が進むと、爪部材が制限位置まで閉じようとし、その力を受けつつ多結晶原料が落下用切り込みで分割され、爪部材か

ら外れて落下する構成にすることが好ましい。

【００１３】多結晶原料の落下用切り込みは、例えば断面楔形または断面矩形状に形成することができる。

【００１４】

【実施例】以下、図面を参照して本発明の実施例を説明する。

【００１５】図１は本発明の多結晶原料および多結晶原料支持治具の一実用例を示しており、そのうち（ａ）は多結晶原料を支持した状態を示す側面図であり、支持手段が左右位置に来るように描かれ、多結晶原料は断面で示されている。同図（ｂ）は多結晶原料の溶融途中の段階であり、同図（ｃ）は多結晶原料の残部が落下するところを示している。図２（ａ）と（ｂ）は、図１の支持治具のフレーム及びその周辺を示す上面図である。

【００１６】多結晶原料支持治具１０は、多結晶原料１を支持して図示しない単結晶製造装置のルツボに供給し、これを溶融させるための治具である。

【００１７】多結晶原料１は円柱形などの棒状であり、その上部周面には、爪部材を引っ掛けるための溝１７が形成されている。この支持用の溝１７は多結晶原料１の周りを１周しているが、一部分に形成するだけでも良い。

【００１８】また、多結晶原料１の上面には、断面楔形又はＶ字型の落下用切り込み１８が形成されている。落下用切り込み１８の深さは、支持用の溝１７の底部よりも深くなっている。図２（ｃ）と（ｄ）は、それぞれ落下用切り込み１８の上面形状の一例を示している。

【００１９】多結晶原料支持治具１０は、フレーム１１を有している。フレーム１１は円形部分と軸部分を連結した形状になっている。

【００２０】フレーム１１の円形部分には、多結晶原料１を支持するための単数又は複数の支持手段１４が取り付けられている。各支持手段１４は、開閉動作をする構成になっている。図２において、（ａ）は支持手段１４を３つ設ける場合の配置を示し、（ｂ）は４つ設ける場合の配置を示している。その際の多結晶原料１の支持位置は、図２（ｃ）と（ｄ）に三角形１５ａで示した位置となる。

【００２１】支持手段１４は連結部材１２と、爪部材１５と、重り部材１６から構成される。連結部材１２は、支点１３を中心として回転可能にフレーム１１に設定されている。連結部材１２は、「く」の字型の棒材であり、その屈曲部が支点１３になっている。連結部材１２の一方と他方の端部には、それぞれ爪部材１５と重り部材１６が設けられている。爪部材１５は、連結部材１２の一端部をかぎ状に曲げて形成できる。

【００２２】爪部材１５は、重り部材１６に作用する重力によって内側に閉じるので（図１（ａ）の矢印Ｂ参照）、多結晶原料１を確実に支持することができる。また、多結晶原料１の支持作業時には重り部材１６を上方に持上げ、爪部材１５を開動作させて多結晶原料１を支持させるので、作業者が多結晶原料に接触せずに作業でき、作業者からの汚染を防ぐことができる。

【００２３】連結部材１２の支点１３から少し爪部材寄りの部分と、それに対応するフレーム１１の底部には、突起１９と２０が配置されている。これらの突起１９と２０は制限部材となり、連結部材の回転すなわち爪部材１５の閉じ具合を制限する。図１（ｂ）のように、両方の突起１９、２０が係合すると、連結部材１２の回転が制限され、爪部材１５がそれ以上閉じなくなる。

【００２４】多結晶材料の溶融が進んで、図１（ａ）のＡ-Ａラインまで溶融すると、重り部材１６に作用する重力によって連結部材１２が前述の制限位置まで回転し、爪部材１５は最も閉じた状態となる。それに伴って、多結晶原料１の残部１ａ、１ｂは、図１（ｂ）に示すように内側に回転するように分割され、爪部材１５の支持から解放される。そして、多結晶原料１の残部１ａ、１ｂは、図１（ｃ）に示すように寄り添った状態で落下する。

【００２５】このように、爪部材１５の閉じる作用によって、多結晶原料１の残部１ａ、１ｂは、外側に広がることなく、ほぼ一塊の状態でルツボ内に確実に落下する。これは、支持ポイント１５ａが何ヶ所あっても同様である。

【００２６】図３と図４に示した別の実施例では、多結晶原料１の上部に形成する落下用切り込み１８が断面矩形状になっている。その他の構成は、図１と図２に示した実施例と同様である。

【００２７】この実施例においても、図３（ｂ）と（ｃ）に示すように、爪部材１５の閉じる作用によって同様の効果を得ることができる。

【００２８】もちろん、落下用切り込みの形状は、断面半円形またはＵ字型等の他の形状でも良い。ただし、落下用切り込みは、これによって複数の支持ポイントを少なくとも複数の組に分断するように形成する。

【００２９】実施例１と従来例１

図１及び図２（ａ）に示した本発明の支持治具（実施例１）と、図５に示した従来の支持治具（従来例１）を用い、直径５”、長さ約６００ｍｍ、重量１８ｋｇの棒状多結晶原料のチャージ試験を行った。

【００３０】その結果、実施例１では、棒状多結晶原料を全て溶融することができ、落下した多結晶原料がルツボや周辺の部材に衝突することもなかった。また、３つの爪部材によって挟むように支持するため、棒状多結晶原料を、傾くことなく安定した姿勢で支持することができた。

【００３１】これに対して、従来例１では、多結晶原料を約１５ｋｇまで溶融できたが、残りの約３ｋｇは溶融させることができなかった。

【００３２】なお、本発明は前述の実施例に限定されな

い。例えば、爪部材を４つ設ける場合には、多結晶原料の上部に設ける落下用切り込みを十字型に形成しても良い。また、連結部材を途中で分岐させ、１本の連結部材に２つ以上の爪部材を取り付けることもできる。

【００３３】

【発明の効果】本発明の多結晶原料および多結晶原料支持治具によれば、多結晶原料を確実に支持することができ、これを最後まで安全に溶融させることができる。

【図面の簡単な説明】

【図１】本発明の多結晶原料および多結晶原料支持治具の一実施例を示しており、（ａ）は多結晶原料を支持した状態を示す側面図であり、支持手段が左右位置に来るように描かれ、多結晶原料は断面で示されている。（ｂ）は多結晶原料の溶融途中の段階、（ｃ）は多結晶原料の残部が落下するところを示している。

【図２】（ａ）と（ｂ）はそれぞれ図１の支持治具のフレーム及びその周辺を示す上面図、（ｃ）と（ｄ）は多結晶原料の支持位置を示す図。

【図３】多結晶原料に設ける落下用切り込みが断面矩形状の場合の図１に相当する図。

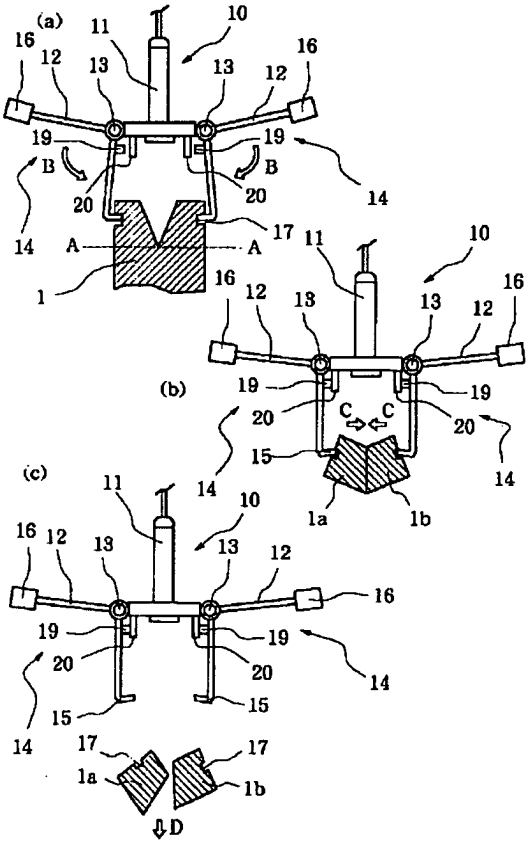
【図４】図３の場合の多結晶原料の支持位置を示す図。

【図５】多結晶原料支持治具の従来例を示す図。

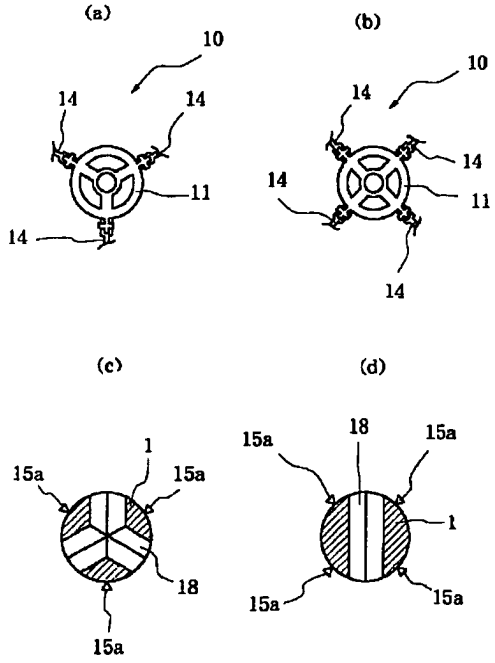
【符号の説明】

１　多結晶原料
１２　連結部材
１３　支点
１４　支持手段
１５　爪部材
１６　重り部材
１７　支持用の溝
１８　落下用切り込み

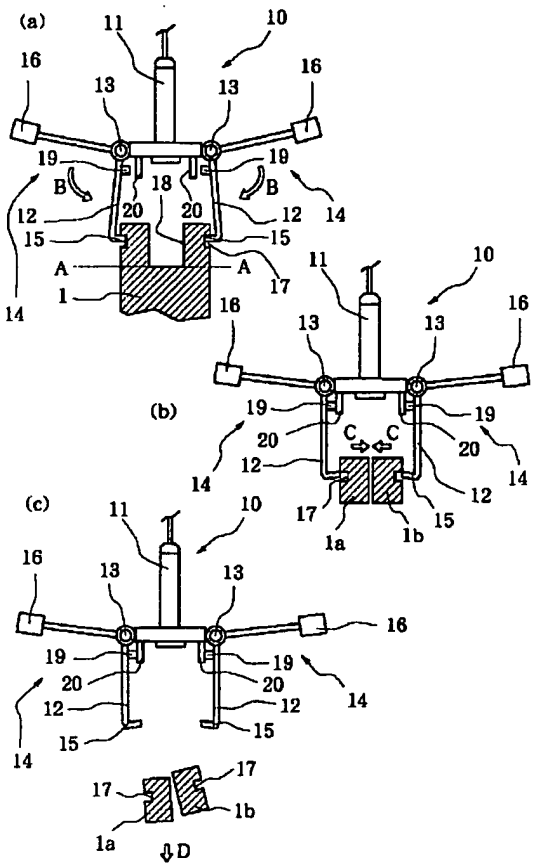
【図１】



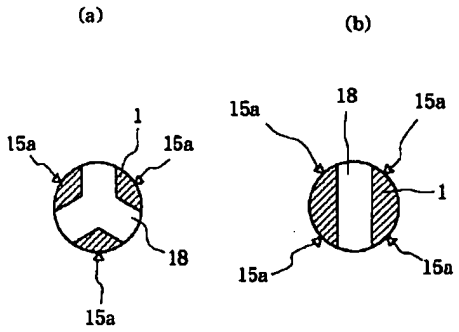
【図２】



【図３】



【図４】



【図５】